rather than to an increase in the amount of moisture present. A Severn coracle is figured (p. 87), and the antiquities lead us on to the stone houses of the Cotteswolds, and the unrivalled half-timber villages of the Trias plain. The chestnut-tree growing from a tomb in Kempsey Church (p. 140) may puzzle the reader who has not seen it. G. A. J. C.

MATHEMATICAL AND PHYSICAL CHEMISTRY.

(1) *Theoretical Chemistry from the Standpoint of Avogadro's Rule and Thermodynamics.* By Prof. W. Nernst. Revised in accordance with the sixth German edition by H. T. Tizard. (London: Macmillan and Co., Ltd., 1911.) Price 15*s.* net.

(2) *Higher Mathematics for Chemical Students.* By J. R. Partington. Pp. v+272. (London: Methuen and Co., Ltd., 1911.) Price 5*s.*

(3) *Abhandlungen der Deutschen Bunsen-Gesellschaft für angewandte physikalische Chemie.* Zweiter Band, Nr. v., Messungen elektromotorische Krafte galvanischer Ketten, mit wasserigen Elektrolyten. By R. Abegg, Fr. Auerbach, and R. Luther. Pp. x+213. (Halle a. S.: W. Knapp, 1911.) Price 8.40 marks.

(1) PROF. NERNST'S text-book occupies a special position amongst text-books of physical chemistry, written as it is by an author of such eminence as a pioneer and investigator in the science, and of such remarkable powers of exposition. From the chemical point of view no better basis for a work of the kind can be adopted than that of Avogadro's rule, for one of the main practical problems of the chemist is the determination of molecular concentrations. Gas densities, osmotic pressures, freezing and boiling points of solutions, conductivity of electrolytic solutions, and electromotive forces are all measured with this primary object in view, and therefore Avogadro's rule is at the root of them all. On this sound chemical basis, then, with the aid of the two laws of thermodynamics, the author has built. His ideas are always clear cut, his expression of them is always ordered and concise, and his mathematical proofs are of special neatness and brevity. It is no wonder, then, that although the book is scarcely intended for beginners, it should have reached a sixth edition in German and a third in English. The advanced student and teacher will specially welcome in this latest edition a detailed account of Prof. Nernst's new thermodynamical theorem, of which so much has been recently heard.

It is a matter for regret that the original English translation of Prof. Nernst's work was far from satisfactory, and so to a considerable extent spoiled the vogue of the book. The present translation has been revised and partly rewritten, and has without doubt been thereby vastly improved. But nothing short of complete retranslation could do justice to the original. However, an occasional awkwardly turned phrase of a distinctly Teutonic flavour will probably not greatly incommode the average reader, and so to all those who desire acquaintance with the facts and theories of physical chemistry and an indication of the lines of progress of the science, this translation of Prof. Nernst's excellent and unique work can be unreservedly recommended.

(2) Of all the mathematical books intended for the use of chemical students which have come under the notice of the present writer, Mr. Partington's is the most serviceable. The author has had a clear notion of the practical problem to be solved, and has performed his task successfully. He does not attempt to teach too much, and strictly adheres to what will be practically useful to the student of physical chemistry. Brief explanations of the nature of the mathematical processes employed are given, and their application is at once shown by well-selected examples. Thus convergent series are illustrated by the two examples of the washing of precipitates, and extraction from aqueous solution by means of ether; maxima and minima by the rate of catalysis of methyl acetate by water; the compound interest law by the decay of radio-activity; and so on. Alike to the chemical student who has no previous knowledge of the differential and integral calculus, and to the student who has learnt the methods of the calculus, but is at a loss how to apply them, this little book will be of considerable value.

(3) The Bunsen-Gesellschaft deserves the gratitude of those who work on the subject of electromotive force for the issue of the volume under review. It consists of three parts: (1) a complete systematic and chronological bibliography of measurements of electromotive forces; (2) a selection of the most trustworthy measurements reduced to a uniform system; and (3) tables of the most probable values of single electrode potentials.

In the bibliographical section the nature of the electromotive combinations measured is given, but not the numerical values obtained. Only aqueous solutions are considered, and such combinations as involve an agency external to the cell are excluded, *e.g.* thermoelectric and photoelectric combinations, decomposition potentials, and the like. The arrangement is by elements according to the groups of the periodic table, both in the bibliographical and in the tabular sections; the single potentials are referred to the normal hydrogen electrode as zero.

With this book of reference at hand the worker at electromotive force can ascertain in the minimum of time what trustworthy work has already been done in his special branch, and see at a glance the most probable numerical values for any electromotive combination in which he may be interested. J. W.

OUR BOOK SHELF.

Field Note-book of Geological Illustrations. Arranged by Hilda D. Sharpe; containing 86 photographs and maps. Pp. 51. (Manchester: Flatters and Garnett, Ltd., n.d.) Price 3*s.* net.

THE idea of this book is a very happy one. Miss Sharpe has collected a number of photographs illustrating geological features, mainly from places in the British Isles, and Messrs. Flatters and Garnett are prepared to supply lantern-slides of most of them at 1*s.* each, or on hire at 1*s.* 3*d.* a dozen. Even as a supplement to the fine series issued by the British

Association, this selection is very welcome, and the book itself, at its modest price, is distinctly suggestive to the teacher. The illustrations, even when most effective, are rarely chosen from hackneyed subjects. We can scarcely do better than Stare Cove, Lulworth, or the Giant's Causeway, which naturally appear; but we can now avail ourselves of the limestone pinnacle of Pickering Tor, of eight views of the River Artro, near Harlech, from its source among the boulders to the sea, and of the Severn Valley in the Triassic plain of Worcestershire. Broad landscapes like the last have too often been neglected. Miss Sharpe gives us also the Silurian escarpments near Malvern, the rounded forms of the Longmynd, and the ice-worn gneissic floor of Sutherland. Details like an erratic near Harlech and pot-holes on the Gelt have also obvious uses. The subject may easily be extended into future volumes, if the enterprise meets with the success that it deserves.

A neat coloured geological map of the British Isles is given, but no useful purpose appears to be served by the insertion of tables of rock-forming minerals or of the classification of rocks, which cannot be regarded as either adequate or appropriate. The statements, moreover, made in this brief form are not always accurate. Opal is only partially described as "hydrated silica, brilliantly coloured." The term "glassy" applied to sanidine ought to have been long ago abandoned. "Carbonate of calcium" does not necessarily crystallise in rhombohedral crystals, since two forms are described below, one of which, aragonite, is here said to be triclinic. In the classification of the stratified rocks, "silica" and "silicates of alumina" are treated as minerals. These matters might be left with the text-books, to which the preface so properly refers.

Die Anzucht Tropischer Orchideen aus Samen. Neue Methoden auf der Grundlage des symbiotischen Verhältnisses von Pflanze und Wurzelpilz. By Dr. H. Burgeff. Pp. iv+90. (Jena: Gustav Fischer, 1911.) Price 3.50 marks.

IT was announced by the French botanist, Noël Bernard, in 1904 that a symbiotic fungus inhabits the roots of many orchids, and that continued germination of the seed of such orchids is dependent upon the entrance of the fungus mycelium to renew the symbiotic union. This conclusion raised further problems, particularly whether the fungus differs in different orchids and how it may be isolated and inoculated. These are the practical points treated by Dr. Burgeff, who provides full instructions for raising seedlings in accordance with rigidly scientific principles. The methods are laborious. It is necessary to make pure cultures of the fungus, obtain aseptic seeds, mingle the two symbionts, grow them artificially, and transfer finally the young plant to natural conditions. The author also cultivated a number of mycelia taken from different plants with the view of distinguishing different varieties or species of fungus; the general result is indicated in a diagram showing that the mycelium of a given culture may serve for one, two, or rarely for more genera. Having thus shown how pure cultures should be made and described many experiments that he successfully carried out on these lines, he indicates a less troublesome method which consists in sowing the seed on sterilised fungus-infected soil.

It is unlikely that professional orchid growers will adopt either of the methods described, because it is in most cases an easy matter to raise seedlings under ordinary conditions by adding portions of the old roots or even soil from old cultures to the compost in the seed-pan. Nevertheless, the researches of Dr. Burgeff are theoretically and practically of great value, and should be carefully noted by growers, as they may serve to explain unexpected failures.

Elementary Applied Mechanics. By Prof. A. Morley and W. Inchley. Pp. viii+382. (London: Longmans, Green and Co., 1911.) Price 3*s*. net.

THIS book is intended for beginners of limited mathematical attainments, and, to meet the needs of such, extensive use is made of graphical methods and of numerical illustrations. Many worked-out exercises are included, together with others intended for solution by the student. Simple laboratory experiments are described. The standard is that of Stage I. of the Board of Education, and the method of treatment is quite orthodox. An introductory chapter on mensuration and measuring appliances is followed by chapters on elementary statical principles, leading up to the consideration of simple frames. Work, friction, and machines are then considered. Five very good chapters on the strength and elastic properties of materials are included, and the elementary laws of hydraulics form the subject-matter of the last three chapters.

The illustrations are clearly drawn, and are mostly correct. An exception occurs on p. 115, where a Prony brake is illustrated, having two mistakes in its design. In the chapters dealing with the composition and resolution of forces, it would have been better to omit the arrows shown on the triangles and polygons of forces. These cannot be shown on the force diagrams for frames, and a habit of inserting arrows which have to be omitted in subsequent diagrams is easier acquired than dropped by the beginner. We also observed several diagrams in which the resultant, found from the force diagram, has not been inserted in its proper place. The principal author is well known from his work on the strength of materials, and the present volume should take a good place among the other elementary text-books on the same subject already in existence.

The London University Guide and University Correspondence College Calendar, 1912. Containing the Regulations for Examinations to be held in 1912 and 1913. (London: University Correspondence College.)

THE private student anxious to graduate at the University of London will find in this volume all the information he needs as to how to proceed. The best plan, in cases where it is possible, is for the student to enter one of the constituent colleges of the University and to follow the suitable course of study arranged for intending graduates; but for young men and women who are compelled to live far away from a college and whose time is occupied during the day, it would be difficult to find more helpful advice than this book contains.

Life in the Sea. By James Johnstone. Pp. vii+150. *New Zealand.* By Sir Robert Stout, K.C.M.G., and J. Logan Stout. Pp. viii+185. (Cambridge University Press, 1911.) Price 1*s*. net each.

BOTH these volumes belong to "The Cambridge Manuals of Science and Literature," a series which is fast becoming representative of every department of human knowledge. Mr. Johnstone provides a discussion of the general economy of the sea, in which the results of recent investigations of the microscopic life of the ocean are given due prominence. The object of the second book is to show faithfully in a brief way what New Zealand is and what has been done by her people, the treatment being such as is likely to appeal to readers who have not seen the Dominion.

These "Manuals" are not of the nature of primers